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CONTENTS

PAGE

PHILLIPS, J. S., M.A., B.Sc., Ph.D. A search for parasites of Dasynine bugs in the Netherlands Indies . . . . . 119–144, 16 figs.

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A SEARCH FOR PARASITES OF DASYNINE BUGS IN THE NETHERLANDS INDIES

By J. S. Phillips, M.A., B.Sc., Ph.D.

Communicated by Dr. A. D. Imms, F.R.S., F.R.E.S.

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With Sixteen Text-figures.

Contents.

	PAGE
Preliminary Remarks	119
Programme of Work	120
Tests with *Homoeocerus marginellus*	121
Tests with *Homoeocerus lucidus*	123
Tests with *Dasynus manihotis*	130
The Egg-parasites	135
Search for Controls in Other East Indian Islands	143
Food-habits of the Dasynini	143
Summary	144

Preliminary Remarks.

From December 1936 to February 1938 a search for parasites of Dasynine bugs was made in the Netherlands Indies. It was hoped to send shipments of any suitable parasites, which might be found, to the British Solomon Islands, where *Amblypelta cocophaga* China, a Coreid pest indigenous to that Group, was causing immature nutfall of coconuts and had already put many thousands of acres out of production. The project was financed by Messrs. Levers Pacific Plantations, who have extensive estates in the Solomon Islands.

Species related to *A. cocophaga* have been recorded from a number of islands in the Dutch East Indies, and, as this group appeared to be the centre of distribution of Dasynine bugs, it was decided to begin the search for their parasites there. Buitenzorg was chosen as a starting-point for the investigation, because of the facilities it offered for the breeding of parasites, and for other details of research. The Netherlands Indies Agricultural Department kindly gave facilities for work at the Instituut voor Plantenziekten, an arrangement which was of immense value to the progress of the research. At least a dozen species of the subfamily Dasynini are known to occur in the East Indies. Most of these have been reported from Java and Sumatra, as collectors have done more work there than in the other islands.

These species are :—

Dasynus cardinalis Bredd.
Dasynus homoeoceroides Bredd. } from Sumatra
Dasynus striatellus Blöte

Dasynus piperis China, from Sumatra, Borneo and Bangka

Dasynus acutispinis Blöte from Borneo
Dasynus kalshoveni Blöte
Dasynus laminatus Stål } from Java
Dasynus manihotis Blöte
Dasynus puncticeps Blöte, from Celebes
Amblypelta semifulva Blöte, from Timor Archipelago
Amblypelta sp. from Lombok
Amblypelta sp. from Kei Islands.

Specimens of these insects may be found in the Museums of Leyden and London, but nothing was known of the life-histories and distribution of most of them. The exceptions were *D. piperis*, the pepper-bug, which has been well studied and described by Van der Vecht (1933) and *D. manihotis*, a species which attacked cassava in central Java in 1931 and 1932, concerning which Leefmans published some notes (1935).

Programme of Work.

The object of research was to discover enemies of Dasynine bugs and to send consignments of any promising ones to the Solomon Islands, where they could be tested against *Amblypelta cocophaga*, the coconut-bug. Van der Vecht (1933) had discovered three egg-parasites of *D. piperis*, and, on his advice, it had been decided to try and establish one of these—the Encyrtid wasp, *Ooencyrtus malayensis* Ferrière, in the Solomons. The other two egg-parasites were believed to be too specific to be likely to establish themselves.

It was known that the nymphal stages of the Capsid bug, *Helopeltis antonii* Signoret, a great pest of tea and cacao in Java, were parasitised there by a Braconid wasp, *Euphorus helopeltidis* (Menzel, 1926, 1928). This parasite gives 50–90% control in certain areas in west Java, but unfortunately its distribution is patchy and not very extensive. It was hoped that a parasite of the nymphal or (and) adult stages of a Dasynine bug might also be found here, as egg-parasites alone would not be sufficient, in my opinion, to exercise the drastic control necessary to stop nutfall (Phillips, 1940).

Though no nymphal or adult parasites of Coreids were known to exist in the East Indies, a Tachinid fly had been reported (Myers, 1932) from the West Indies, parasitising the nymphal and adult stages of a Coreid and a Pentatomid.

General Lines of Work.

It was decided to study the local Dasynine bugs and work out their life-histories; to discover what parasites attacked them; and to breed up supplies of the most suitable species to act as a host for *Ooencyrtus* and for any other suitable parasites, which might be found, for shipment to the Solomon Islands.

Selection of a Suitable Host.

Of the species which might have been convenient for work at Buitenzorg, *D. piperis*—the only Dasynine bug whose bionomics were known—does not occur in Java, and its importation is strictly prohibited, owing to the danger of damage to the local pepper crop. There remained three species of *Dasynus* known to occur in Java, viz. *D. manihotis*, *D. laminatus* and *D. kalshoveni*.

A search for *D. manihotis* was made at once (January 1937) by the Agricultural Officer at Solo, in whose district it had been found previously, but no

bugs were discovered. *D. laminatus* had been collected a number of years ago near Batavia, but its host-plant had not been recorded: a search failed to locate it. *D. kalshoveni* had been observed only in central Java. But at Buitenzorg itself, the closely-related *Homoeocerus marginellus* (H.-Sch.) is common on the cover-crop *Calopogonium mucinoides*, and it was known that the egg-parasite *Ooencyrtus malayensis* could be bred from its eggs. Accordingly this bug was used as an egg-parasite host.

Initially three lines of work were adopted: (1) the eggs were used for the breeding of *Ooencyrtus* stock; (2) nymphs were bred in the laboratory and caged out on food-plants in the Institute grounds: later they were examined at fortnightly intervals for any individuals which might have been parasitised in the interim; (3) field nymphs and adults were examined for parasitised individuals. (The term "field" is used to differentiate insects caught in the field from those bred in the laboratory.)

Tests with Homoeocerus marginellus (*H.-Sch.*).

Breeding of *Ooencyrtus* stocks (figs. 1 and 2).

Technique.—Fresh eggs were collected daily from caged adult bugs. A camel-hair brush was used for moving the eggs. Batches of eggs (about 20 per batch) were gummed to narrow strips of card.

1

Fig. 1.—Method of packing parasitised eggs.

16

Fig. 16.—Egg-cards and parasites.

The date, number of eggs and name of species were written on the slips. These were slid into small tubes and a dozen parasites (1 male to each 3 females)

were placed inside each tube with a section of evergreen leaf, dotted with minute droplets of a honey-water mixture (1 : 3) for food.

Two days later the parasites were removed, the date recorded and the eggs left to hatch. The same parasites were used for a second batch of eggs, but for no more.

The tubes were stoppered with a wad of cotton-wool, covered with a layer of muslin. They were prevented from rolling about by stops of cork or cotton-wool.

The parasites were moved from one tube to another by covering the old tube with black cloth and exposing the new one to the light. As direct sunlight through the glass of the tube is fatal to the parasites inside it, they were always kept well shaded. When the eggs hatched—an average of 13 days later—the date was recorded, and the newly-hatched insects were used to parasitise fresh batches of eggs, a day being allowed for mating before they were used.

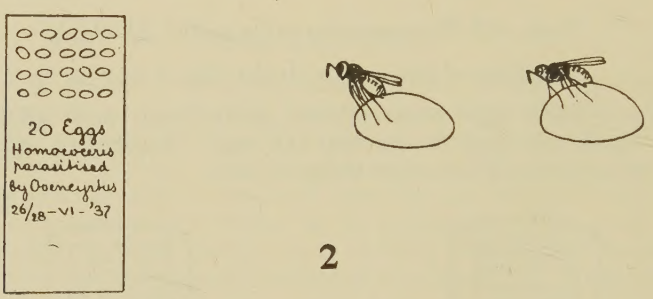

Fig. 2.—*Ooencyrtus* puncturing eggs.

An average of $1\frac{3}{4}$ individuals per egg emerged when *Homoeocerus* was used as a host, but later experiments with other species of host-eggs showed that any number up to as many as 18 individuals might hatch from one egg, depending upon its size. The size of the emergent parasites was also found to vary considerably.

Examination of " Field " Nymphs and Adults for Parasites.

About 300 individuals were examined and some were dissected to see if any had been parasitised. The results were always negative.

Breeding, Caging in the Open and Subsequent Examination of Nymphs.

As only a few nymphs were found in the field, it was decided to breed stocks of them in the laboratory, then to cage them out on *Calopogonium* and re-examine them later to see if any had been parasitised in the cages.

Technique adopted.—This type of Coreid is not very easy to breed indoors. Essentials of successful rearing are adequate accommodation, fresh, juicy food, and a humid environment.

Eggs.—Each day's batch was placed in a Petrie dish, the bottom of which was covered with filter paper, the top being secured with muslin held in place by a rubber band. Date of oviposition, name of species and number of eggs present were written on a slip of paper which was pinned to the muslin top.

Nymphs.—Jam-jars were used : 5 nymphs to a small jar, 10 to a large one. The jars were laid on their sides and wedged with cork or cotton-wool to

prevent them rolling. Each jar contained nymphs hatched on the same day. The top was covered with muslin, secured with a rubber band, and to this was pinned a slip of paper with particulars of the batch ; data of the succeeding instars were recorded on the slip. Food, consisting of shoots of *Calopogonium*, was changed daily. A piece of white paper was placed inside each jar ; soiled papers were changed for fresh ones every few days. A swab of soaked cotton-wool was also enclosed to ensure a moist atmosphere.

Adults.—Adults (used for oviposition) were kept in large-sized breeding-cages of wood and wire-mesh, 15″ × 20″ × 24″, the legs (6″) of which were tanglefooted against ant attack : the cages had glass-fronted doors. Each cage held about 50 adults. Food-plants (*Calopogonium* shoots) were placed in jars of water, their stems wedged firmly in the jars with cotton-wool. The food was changed daily, all eggs and dead adults were removed and the cages cleaned out and sprayed with an atomiser. As adults often laid their eggs on the wire-mesh, this was later lined with unglazed paper. Particulars of the bugs were written on slips of paper attached to the cages.

Data.—In addition to these paper slips, a life-history table was kept and particulars entered on it from the slips.

Caging of Bred Bugs.

Nymphs of stadia II to IV were caged out on *Calopogonium* growing in the Institute grounds. Two weeks later these were brought into the laboratory for examination to see whether they had been parasitised. The cages used were made of wood and wire-mesh and were 2 metres long, 1·5 metre wide and 0·5 metre high : they had no bottom. The mesh used differed according to the size of the nymphal stadium and was just large enough to prevent nymphs escaping. It was hoped that it would be sufficiently large to allow the ingress of any possible parasites of the various stadia. The duration of each nymphal instar under these conditions was about one week, except the first one, which lasted three days.

About 500 nymphs in all were caged out in these experiments. Some were lost but most of them were recovered. When re-examined after 2 weeks in the cages, none of them showed any signs of parasitisation.

Tests with Homoeocerus lucidus *Walker.*

On 16.i.1937 a consignment of live adults of this species was sent to me by Dr. Kalshoven from a teak forest south-east of Semarang. Some years earlier, he had collected specimens of this bug in a number of localities in this area and had sent them to the Leyden Museum; but, as it was of no economic importance, no one had worked on the species.

With this consignment was a note that the bugs were fairly plentiful and that they had been found feeding on a shrub, *Albizzia lebbeckoides*, which occurs as forest undergrowth.

As the bug was very similar in appearance to *Amblypelta cocophaga*, though somewhat larger, and as it was found to mate and oviposit freely in captivity, it was decided to use its eggs as parasite hosts instead of those of *Homoeocerus marginellus*. Accordingly arrangements were made for a supply, so that they might be used as hosts for *Ooencyrtus* and any other suitable parasites which might be found later. Further, nymphs and adults of this bug were sent from the forest, so that they might be examined for parasites. As the bionomics of this bug were unknown, it was also essential to work out its life-history.

The habitat of the bug in central Java was visited in February 1937. A typical locality inspected was Gedangan, a " halt " in the teak forests south of Semarang and about 20 miles north-west of Sourakarta (Solo). This place is below the 100-metre level and the climate is hot and humid during the wet monsoon. There is a dry season from about May until the beginning of October, which month is usually marked by the irregularly showery weather preceding the wet monsoon season, which sets in a month or so later. During the dry season, the climate, though still hot, becomes less humid and the bug disappears from the teak forests.

The Host-plant in the Teak Forests.

Albizzia lebbeckoides, a leguminous tree belonging to a genus with a dozen representatives in Java, is the host-plant of this bug. It occurs as sparsely-scattered undergrowth throughout the older stands of the teak forests, a shady habitat somewhat darker than is a coconut plantation of mature palms.

Bugs were not found on the larger trees but on the young growth which had sprung from the butts of felled or burnt trees, which bore an abundance of shoots. Bugs were found on nearly every shoot, though in small numbers only; but I was told they had been noticeably more numerous in the preceding month.

These new shoots are covered with a viscous exudation and this protects the young nymphs from ant attack. In fact, many of these sticky stems were found to be covered with dead ants, the commonest species being *Anoplolepis longipes*, the " gramang " ant.

Effects of Feeding on the Host-plant.

The adults, which are rather gregarious, were noticed puncturing the stems of the saplings, and these punctures showed up as small brown dots; but the nymphs always appeared to feed on the shoots and young leaves. The feeding punctures on the leaves occurred as brown dots surrounded by a yellow area; occasionally leaves dropped off, but as a whole the impression gathered was that the effects of the punctures were strictly local and not serious, unless a large number of bugs were present, as later, when about 100 nymphs were caged on one sapling by a member of the forest staff, an act which resulted in complete defoliation of the branches caged.

I mention the slightness of the damage, as it is in striking contrast to the serious injury inflicted by *D. manihotis* on cassava stalks, by *A. cocophaga* on young coconuts and by *A. lutescens* on papayas—all cultivated crops which have been attacked in recent years by Dasyninae.

Stages found on the Host-plant.

At Gedangan the adult bugs were conspicuous on the young saplings and mating was much in evidence. The nymphs, *per contra*, were much more difficult to detect, as at rest their coloration and posture exactly resembled the stalk of a young shoot with its new, unfolded leaf. All stages of the nymph were found. Eggs were laid on both stalk and leaflets—mostly on the undersides—sometimes singly, sometimes 2, 3 or 4 together. A parasitised egg was found and taken back to Buitenzorg: on hatching, eight Chalcid parasites of an undetermined species emerged from it.

Arrangements for Supplies.

In the hope of finding further parasites, arrangements were made with the Gedangan staff to collect eggs and to send weekly batches to Buitenzorg. Consignments of nymphs and adults were also sent, so that these could be examined for nymphal and adult parasites and a supply of adults could be maintained at the Institute to lay eggs for use as hosts for any parasites which might be found.

Examination of " Field " Bugs for Parasites.

About 500 adults and nymphs were examined and some were dissected to see if any had been parasitised. Results were always negative.

Life-history Work (figs. 3, 4, 5 and 6).

Rearing on cut shoots in the laboratory.—As the host tree of this bug does not occur at Buitenzorg, attempts were made to rear the insect on cut shoots of

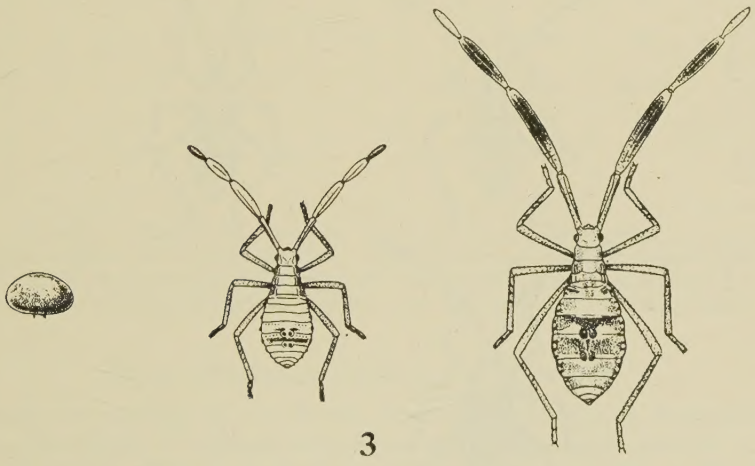

Fig. 3.—*Homoeocerus lucidus* : egg and larval stadia I and II.

other species of *Albizzia*, viz. *A. moluccana* and *A. falcata* and also by caging them on trees of these species. Unfortunately these proved unsuitable and the nymphs usually died during their second instar. Only 4 individuals of those bred during February and March on these plants survived until the fourth instar, when they, too, died. Their stadia were as follows :—

Nymph	Egg stage (days)	1st Instar (days)	2nd Instar (days)	3rd Instar (days)
a	8	3	4	4
b	7	4	4	5
c	8	3	5	4
d	8	4	4	4

Mass-rearing on A. lebbeckoides *at Gedangan.*—A number of bugs was bred in mass by one of the forest staff, caged on living trees for me at Gedangan, to see whether any parasites would attack the nymphal stages. No notes were made of the duration of the different stadia, but the combined egg and nymphal stages were found to aggregate from 4 to 5 weeks.

The forest-bred adults, sent to the Institute, lived for the week or so on the diet mentioned above. From these it was possible to secure a few eggs as hosts for some of the parasites bred from the eggs sent from Gedangan.

Discovery of an alternate Host-plant.

At a later stage of the investigations, an alternate host-plant, *Albizzia stipulata*, was discovered, when at once it was found that small numbers of the bug could be located in west as well as in east and central Java, and on the

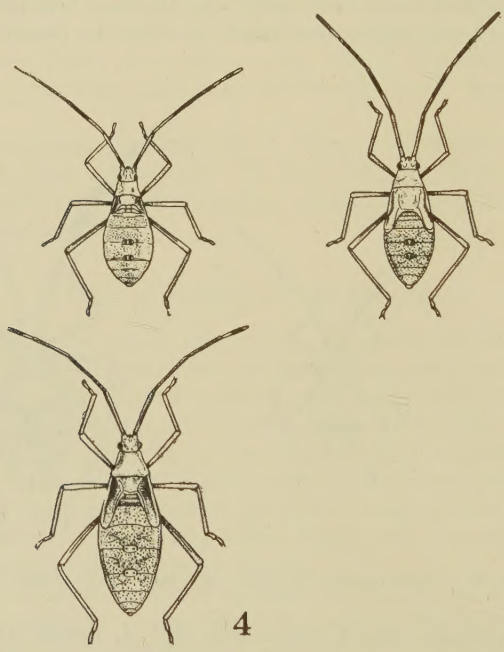

Fig. 4.—*Homoeocerus lucidus* : larval stadia III, IV and V.

uplands as well as on the plains. It was from then on unnecessary to depend on the central Java teak forest supply, available only in the monsoon season, when *A. lebbeckoides* bore fresh shoots (during the dry season it did not do so), for small supplies of bugs could be obtained on the slopes of Mt. Salak within ten miles of the Buitenzorg Institute. As Buitenzorg has no real dry season, the new host-plant bore new shoots throughout the year. However, the distribution of the bug was very patchy, as it occurred in small pockets only and considerable areas covered by this new host-plant were searched, often without finding any of the bugs.

Rearing on *Albizzia stipulata.*

Seedlings of this plant were obtained and planted in the Institute grounds, and it was then possible to rear *H. lucidus* from the egg-stage to maturity. The eggs were obtained from caged adults, and the nymphs were reared in cages of split bamboo and mosquito netting, placed round the young saplings. It was necessary to protect the cages from ant attack by smearing tanglefoot on the stems of the plant and on the bamboo cage-supports.

As will be seen from the following table, the average nymphal life lasted 22 days. The egg-stage averaged 7 days, so that a total period of 29 days elapsed between oviposition and the emergence of the adult. As the first egg was not laid till 9 days after this, the complete life-cycle may be taken as about 38 days.

Life-History Test of 23 *Homoeocerus lucidus* Nymphs.

Test No.	No. of nymphs	Duration of Instars in Days						Remarks
		I	II	III	IV	V	Total	
I	4	4	5	3	3–4	5–6	21	2 ♂♂ 2 ♀♀
II	4	4	5–6	4–6	4	5–6	23	2 ♂♂ 2 ♀♀
III	7	3	4–5	4	4–6	6–8	21–25	2 ♂♂ 5 ♀♀
								6 ♂♂ 9 ♀♀

Notes.—Average nymphal life, 22 days. The sex of the nymphs does not appear to influence the duration of the nymphal life. These tests were made in August 1937, but as there is no real dry season at Buitenzorg and the monthly temperature throughout the year shows little variation, this probably gives a fair average picture of the nymphal life.

Mating, Oviposition and Length of Adult life.

Through the courtesy of the Forest Experiment Station at Buitenzorg, a number of seedlings of *Albizzia stipulata* were obtained and planted in the Institute grounds. Some were used for rearing nymphs caught on Mt. Salak to the adult stage and others were used for the following experiment.

Nine pairs of newly-emerged adults (bred at the Institute) were placed in cages of mosquito netting and split bamboo. A pair of bugs was placed in each cage. The cages were suspended from bamboo gallows, and each was placed round a seedling *Albizzia*. Both bamboo supports and the plant stems were smeared with tanglefoot to prevent ants entering the cages.

The cages were examined daily, and any eggs found therein were removed and the number recorded. 3 or 4 (sometimes 6 or 8) eggs were often found close together, suggesting that the bug lays its daily clutch in one operation and not at intervals throughout the day. Copulation was not observed until 5 or 6 days after emergence, but as observations were sporadic, it might easily have taken place earlier and remained unobserved. It appears to occur intermittently throughout the adult life. Bugs do not start laying till more than a week after emergence as adults.

The results of the tests were as follows :—

Number of Eggs Laid by the Bugs.

Month	A	B	C	D	E	F	G	H	I
ix.	129	160	86	90	146	97	91	81	63
x.	132	140	130	129	167	155	147	139	129
xi.	133	121	123	126	120	129	132	129	133
xii.	71	72	81	95	139	95	122	123	95
i.	77	115	49*	67	110	109	103	76	56
ii.	23	24	—	24	47*	37	60	55	18
iii.	0*	42	—	2*	—	47	21*	70	60
iv.	—	6*	—	—	—	13*	—	12*	19*
Total .	565	680	469	533	729	682	676	685	573

Average number of eggs laid by female bug, 618; average adult life, 7 months. These tests were carried out during the later part of 1937 and the earlier part of 1938.

* Female died during this month.

Seasonal Distribution of *Homoeocerus lucidus*.

Central Java has a well-marked dry season, lasting from about mid-June to end-September, and a wet season from November to March. During the inter-

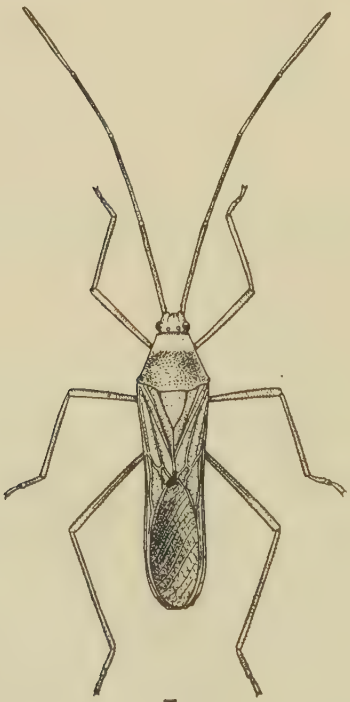

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Fig. 5.—*Homoeocerus lucidus*: adult male. Fig. 6.—*Homoeocerus lucidus*: adult female.

seasonal months the weather is changeable. The vegetation reflects these seasonal changes. During the wet monsoon and until the dry season has set

in, the saplings of *Albizzia lebbeckoides* have a profusion of young succulent shoots, and there is thus a plentiful food-supply for *H. lucidus*. From June onwards, this tree does not put forth any new shoots until the rains commence again.

From this, one would expect that the *Homoeocerus* population would increase enormously during the wet season, attaining a maximum towards its close, when it would either migrate or die off, leaving a few hardy individuals to extract what sap they could from the tough, dry-season foliage. Actually the course of events appears to be rather different, though it must be remembered that the following observations are based only on a few personal visits in 1937 and on information given me by members of the forest staff, who had no particular reason to observe this bug until the month prior to my first visit—*i.e.* January 1937. The population of the bug does increase rapidly during the first half of the wet season, reaching its peak in January. In February the population has already started to decline. By the end of April, though I found there were still plenty of young shoots for food, the bugs have become scarce. By early June the bugs seem to have completely disappeared, though a few young shoots still remain on the saplings. Further searches in July and August (1937) also failed to yield bugs. For the other months of the year I have no data, except the statement of the foresters that they do not recollect seeing the insect during the dry season.

From the above, it is obvious that the decline of the population occurs before the failure of the food-supply and therefore cannot be due to it, though the absence of suitable food during the dry season may prevent a rebuilding of the population at that time of year. What other reasons might be responsible for this fluctuation in the bug population ?

Egg-parasites.

Of the first two consignments of eggs collected at the end of February and beginning of March at Gedangan, more than half were parasitised : and, as a number of these eggs were newly-laid, it is fair to assume that some of the unparasitised ones would have been parasitised had they been left in the forest, and therefore that the actual percentage of parasitisation in the forest at that period was higher than that of the samples taken.

Van der Vecht found (1933) that a related bug, *Dasynus piperis*, was attacked by similar egg-parasites, which parasitised 78% of its eggs.

However, in the later consignments of eggs sent from Gedangan, the percentage of parasitism was very much lower : furthermore, samples of eggs were again taken during the following February and March, when the percentage parasitised was found to be quite small (particulars of this are given later). So that, although it seems probable that egg-parasites are an important factor in the control of this bug, it is unlikely that they are alone responsible for its actual disappearance from the teak forests at the time indicated.

Migration.

Do the bugs migrate to a host which will afford them an ample food-supply during the dry season ?

At the beginning of May, when the supply of bugs was disappearing from the low-lying forests, I found specimens on another species of *Albizzia*, *A. stipulata*, which grows at higher altitudes. The bugs were found at elevations varying from 500 to 3300 feet. Some were collected within about 3 miles of the

teak forests and others from various localities in west, central and east Java. Even during the dry season, the higher elevations are usually kept moist by showers or mist, so that saplings of *A. stipulata* have a continuous growth of young shoots. Though the bugs were never found in large numbers on these shrubs (as they are on *A. lebbeckoides* during part of the wet monsoon), individuals were obtained from them from May to September. There was no opportunity of discovering whether they are present throughout the year, but it seems likely that they are. I have no evidence either for or against migration from one species of host-plant to the other : but if the *Homoeocerus* population of the teak forests dies out completely during the dry season, the fact that supplies of the alternate host-plant may be found in the uplands, a few miles to the south and west, may explain why the forests are repopulated in the following wet monsoon season.

Tests with Dasynus manihotis *Blöte* (figs. 7 and 8).

This bug was first noticed in May 1931, when it attracted attention by attacking a small area of cassava [1] in a rather inaccessible region in the

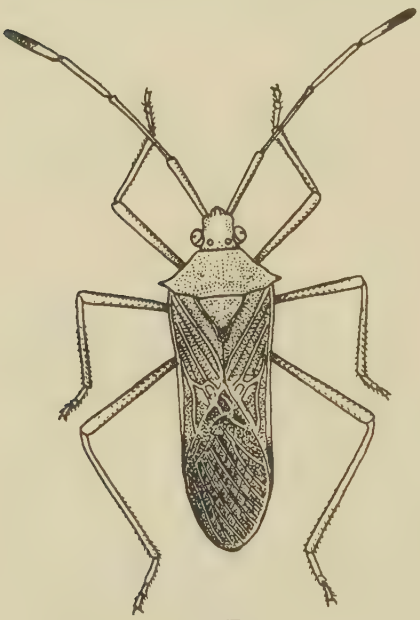

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Fig. 7.—*Dasynus manihotis* : adult male.

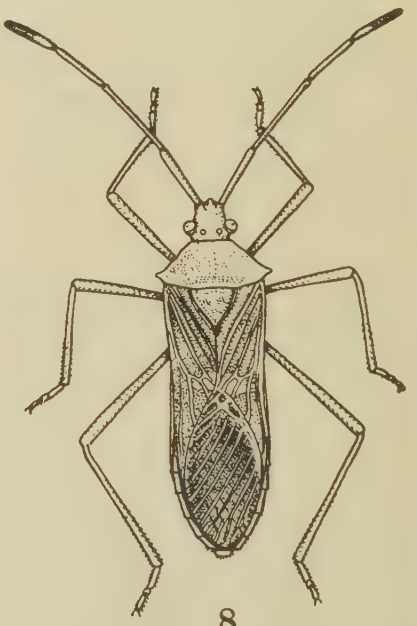

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Fig. 8.—*Dasynus manihotis* : adult female.

Goenoeng Kidoel near Wonogiri. A second attack occurred in the same restricted area in the following year, when specimens were sent to Dr. S. Leefmans at Buitenzorg, where he studied its bionomics (1935). A search of the neighbourhood attacked failed to discover any bugs in the surrounding scrub, so that the wild host-plant of this insect remained unknown.

Cassava is a seasonal crop which is pulled up at the end of July, so that the

[1] It is interesting to note that R. A. Lever discovered a new species of *Amblypelta* (*A. gallegonis* Lever) feeding on cassava at Pele, Ysabel, British Solomon Islands, in 1935.

pest would have been automatically checked at this time of year, but a remarkable feature of these attacks was that both in 1931 and 1932 they were confined to two small patches, some 15 hectares in extent, and did not spread further: nor have similar attacks ever been reported from any other patches in the neighbourhood, though searches have been made there. Further, this bug is not known to attack cassava in any other part of Java, though the crop is widely grown throughout the island and inquiries have been made in many localities.

Nature of the Damage.

Both nymphs and adults puncture the upper part of the stems, causing a brownish discoloration round the punctures and a shrinkage of the tissues. The leaves above the punctures wither and fall. New leaves may develop above the injury, but the growth of the plant is seriously retarded. The signs of injury are very noticeable, so that one may see at a glance whether the bug is present in a cassava patch or not.

Early Life-history Studies.

Leefmans tried to rear this insect at Buitenzorg in 1932, but he found that the nymphs did not thrive on the food provided, nor would the adults propagate. Eventually he managed to rear 3 nymphs through to the adult stage by keeping them in jars and giving them a mixed diet of cassava, bamboo, sweet potato and a *Centrosema* sp. The egg stage lasted 7 days and the nymphal stadia aggregated 55–57 days, a period which I believe to be about twice the normal nymphal life in the field. He concluded that cassava was not the usual food of this bug and that it was only attacked owing to the lack of the normal food-supply. My later experiments would seem to confirm this.

Minor Outbreak in 1937.

No further outbreaks occurred in the four following years. At my request, a search was made during January 1937 in the area previously attacked, but no *D. manihotis* were found. In February I visited the district: it consisted of small, scattered patches of terraced cassava in very hilly country at an elevation of about 2000 ft. and about six miles due east of Wonogiri. Just above the patches, near the top of the hills and in very shallow, rocky soil was found some sparse, scattered scrub. Both scrub and cassava were searched but no bugs were found.

Early in April I received a small consignment of these bugs from the local Agricultural Officer with the news that they were appearing again in the same patches they had infested in 1931 and 1932. The dry season had not yet set in and at the end of this month I revisited the area and found that the attack was very slight and that few insects were to be seen. A few individuals of an allied Coreid (subsequently identified as *Homoeocerus javanicus* Dallas) were found in these patches, too, but whether they were also attacking the cassava is uncertain. Most of the punctures noticed were at the intersection of leaf-stalk and stem, resulting in a drooping, withered leaf-stalk, which in conjunction with the dark puncture-mark was very conspicuous (figs. 9 and 10). In early June the district was revisited, when the bug population was still very small. Normally the dry season has commenced by then, but in 1937 it was late and there had been frequent and heavy rains instead. It is conceivable that the attacks on cassava are made by this bug when its normal food-supply dis-

appears : and if, as in the case of the allied species, *Homoeocerus lucidus*, this food consists of the young shoots of native trees, the dry season may well exhaust the supply of these in this rocky, exposed area of mountain terrain. The isolated, restricted and sporadic attacks of this bug on cassava are paralleled in a remarkable way by its relatives *Amblypelta lutescens* Distant and *Dasynus fuscescens* Distant on bananas in Queensland.

9

Fig. 9.—Cassava stem injured by *Dasynus manihotis*.

Other parts of this mountain range (Goenoeng Kidoel) were reconnoitred, and though many areas of cassava and their adjacent fringes of scrub were searched, no tapioca-bugs were found, nor had the inhabitants seen the insect in previous years.

Arrangements were made with the local Agricultural Officer to search for eggs and to send weekly batches to Buitenzorg. Ten small batches of parasitised eggs were sent during June and July, but the percentage of parasitism was very low; particulars are given later. At the beginning of August the cassava was harvested, so that no more field work was possible except in the scrub.

Wild Host-plants of *D. manihotis*.

In early June, arrangements were made for a systematic and prolonged search of the scrub vegetation.

During June and July two men of the local agricultural staff searched the area for 33 days : during the whole of this period only 24 bugs were found, and these occurred on five different species of trees and in no case were the bugs discovered feeding. The records were as follows :—

3 adults on *Albizzia procera* (Leguminosae).
2 nymphs on *Albizzia falcata* (Leguminosae).
4 adults on *Acacia villosa* (Leguminosae).
5 adults on *Dalbergia latifolia* (Leguminosae).
8 adults and 2 nymphs on *Melochia umbellata* (Sterculiaceae).

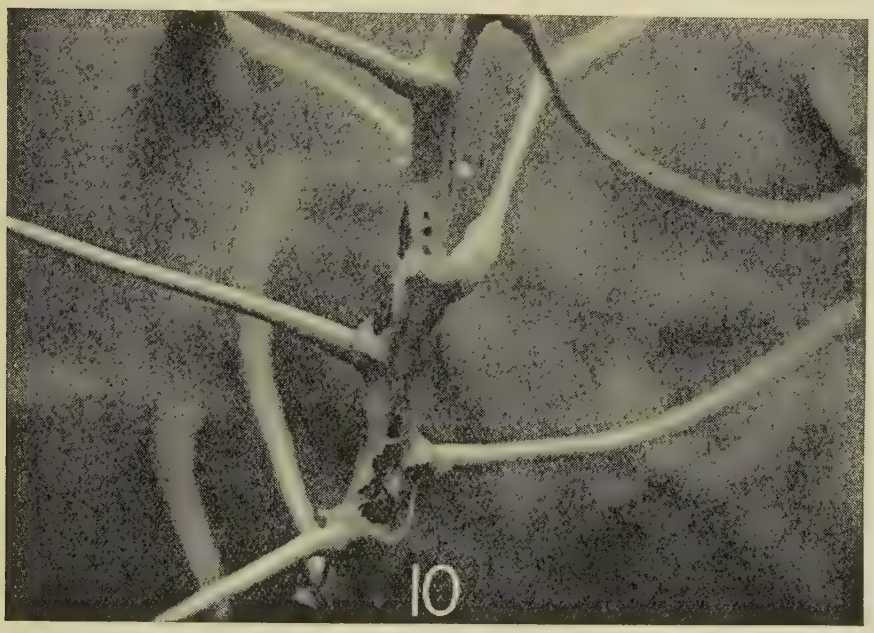

Fig. 10.—Injury to cassava by *Dasynus manihotis.*

The unsatisfactory nature of this evidence indicated that further searches should be made, and accordingly I requested the Agricultural Officer to have further explorations of the scrub carried out. This was done with the following results :—

Host-tree.

Javanese name	Latin name	No. of bugs found
Krandang	*?Canavalia ensiformis*	2
Sengon djawa	*Albizzia stipulata*	8
Senoe	*Melochia umbellata*	1
A species	of grass	2
Tekik	*Albizzia lebbeck*	18
Weroe	*Albizzia procera*	79
Watapana	*Acacia villosa*	36
Kemlandingan	*Leucaena glauca*	4
Boengoeng	Not known	2

In all but 11 instances, where they were found on other (unspecified) parts of the tree, the bugs were observed on the leaves—usually on the young ones.

On 9th November the bugs were observed sucking the young leaves of *Albizzia procera* : this is the only instance recorded. On five occasions, leaves of this tree and also those of *Albizzia lebbeck* were noted to have a withered appearance where the bugs were found, suggesting that this was due to the bugs feeding. From the above it seems highly probable that *Albizzia procera* is a wild host-plant of *D. manihotis* and that *Acacia villosa* and *Albizzia lebbeck* are likely alternate hosts and possibly *Albizzia stipulata* too. The other plants recorded above were probably only accidental resting-places. In all, 152 bugs were found during nine days of search between 16th September and

Fig. 11.—Method of rearing *Dasynus manihotis*.

14th November. The greatest number of bugs found on any one tree was 10 on *Albizzia procera*.

Judging from these records, it would appear that *Dasynus manihotis* is present in the scrub in small numbers only. But allowance should be made for the facts that the scrub is rather sparse and the terrain is rocky and very steep, so that a search is an arduous business.

Life-history Work (fig. 11).

As Leefman's jar technique had proved unsatisfactory in 1932, I tried to rear this bug on living cassava plants. Use was made of sample patches in the Agricultural Experiment Station grounds at Buitenzorg, where it was possible to test different varieties of cassava, but the variety used appeared to make no difference. Batch VI was reared on *Centrosema*, which Leefman's tests suggested might be a preferred food : it proved otherwise. The tests were

made during the period 19th June–11th August and the nymphs used were all hatched from eggs sent me from attacked cassava patches in the Wonogiri district.

The results suggest that the bug may not yet be completely adapted to cassava as a food, and it is possible that this is the reason why its attacks have never spread and why their incidence is so sporadic.

From these records it seems likely that the normal nymphal life in the field is about 30 days. The egg-stage lasts 7 days. Unfortunately it was not possible to gather any information on the length of adult life and the number of eggs laid.

Life-history Tests of *Dasynus manihotis* Nymphs.

Test No.	No. of Nymphs	Duration of Instars in Days						Remarks
		I	II	III	IV	V	Total	
I	4	4	5	6–8	6	—	—	Successive stages used for drawing models.
II	5	4	4	—	—	—	—	All died after 7 days in Instar III without moulting again.
III	4	4	4	7–9	7	12–26	34–50	2 males : 1 female. The other died after a month in Instar V.
IV	4	4	6	6–7	6–7	7–9	30–31	All females.
V	3	6	4–6	3–4	8	6–7	28–30	2 males : 1 female.
VI	3	5	—	—	—	—	—	Reared on *Centrosema* : all died during Instar II.
VII	3	5	4	5–6	6–7	7–15	28–36	2 males, 1 female.
VIII	4	4	—	—	—	—	—	All remained in Instar II for a month without moulting : then died.

The Egg-parasites.

Soon after my arrival at Buitenzorg, I took over a small stock of *Ooencyrtus malayensis* from the Institute staff and started to breed up stocks of this insect for shipment to the Solomon Islands. Van der Vecht had found that 3 species of egg-parasites were responsible for 78·9% control of *Dasynus piperis*, a bug closely related to the Solomon Islands coconut-bug, in Bangka (1933); and he was of the opinion that egg-parasites are an important factor in the control of Coreids in the Netherlands Indies. When, in addition, I found that more than half the first two batches of *H. lucidus* eggs had been parasitised, I began to feel that the introduction of egg-parasites into the Solomons might be of some value. Unfortunately, examinations of batches of the eggs of both *H. lucidus* and *D. manihotis* sent subsequently, all showed a very much lower percentage of parasitism, so that, judging from this evidence alone, it seemed unlikely that the egg-parasites would control *Amblypelta* sufficiently to render it a negligible pest, though they might mitigate the damage it caused.

Indigenous Egg-parasites in the Solomon Islands.

As the eggs of the coconut-bug are very difficult to find in the field, it is hardly surprising that little was known of their parasites. Lever once found a single parasitised egg on the island of Kolombangara and hatched from it a species of *Anastatus*. Of the few eggs collected by my climbers on the Guadalcanal estates none had been parasitised, so that it seemed evident that the amount of control exercised by local parasites was negligible. Since then, four more unidentified Coreid egg-parasites had been found on the islands of Malaita and Guadalcanal, three of which will attack *Amblypelta* eggs; but none of these is of any importance.

Homoeocerus lucidus Egg-parasites in Java (figs. 12, 13, 14 and 15).

From the first batch of 80 parasitised eggs sent from Gedangan (ii.1937), four species of egg-parasites emerged. These were subsequently identified in

12

Fig. 12.—*Ooencyrtus* sp. n.

London as *Ooencyrtus* sp. n., *Tetrastichus* sp. n., *Hadronotus homoeoceri* Nixon and *Anastatus* sp. ?*dasyni* Ferrière. In all, ten batches of eggs—1242 eggs—were sent from Gedangan from the end of March to the beginning of May: details of the batches are shown below. One other parasite, *Ooencyrtus malayensis*, appeared in the 8th and 10th batches, but only in 3 eggs. The percentage parasitism of each species showed great variation. In the following year, eight batches, totalling 757 eggs, were collected at Gedangan during February and March. The distribution of the various parasites was very different from that of the previous year. *Ooencyrtus* sp. n., the most important control in 1937, did not appear at all. Neither did *Tetrastichus*. *O. malayensis*, though slightly more numerous than before, only accounted for 1% of the eggs. *Hadronotus* and *Anastatus* parasitised 5% and 8·5% respectively, as against 7% and 5% in the previous season. Perhaps this is not altogether a fair basis of comparison, for the 1937 period was a much longer one: if, as in 1938, only February and March are taken, *Hadronotus* and *Anastatus* figures would be 8% and 9% respectively, while *Ooencyrtus* sp. n. would be 11·5%.

This is in the lowland teak forest environment of central Java. In the upland scrub country and tea plantations of west Java parasitisation appears to be still lower, and *Ooencyrtus malayensis* would seem to be the most important parasite, such scant data as were available (recorded below) giving it 3% and *Anastatus* 2·5%. *Ooencyrtus* sp. n. was also present, but was even

Fig. 13.—*Tetrastichus* sp. n.

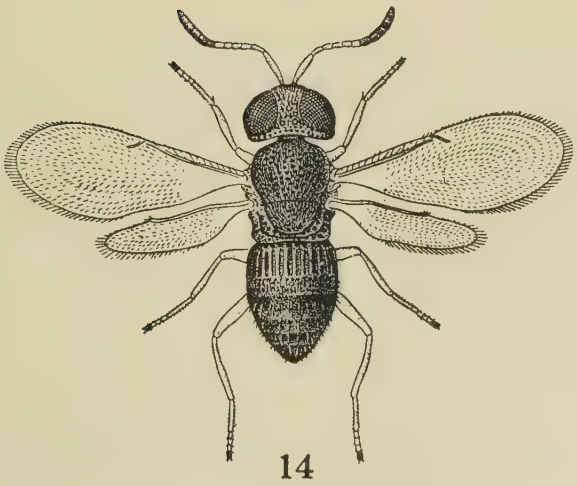

Fig. 14.—*Hadronotus homoeoceri.*

scarcer than the other species.. However, the actual percentages in the field are almost certainly considerably higher, for here the village collectors employed had had no previous experience and a large number of the eggs sent in were damaged : some of these doubtless contained parasites but were recorded as " failed to hatch."

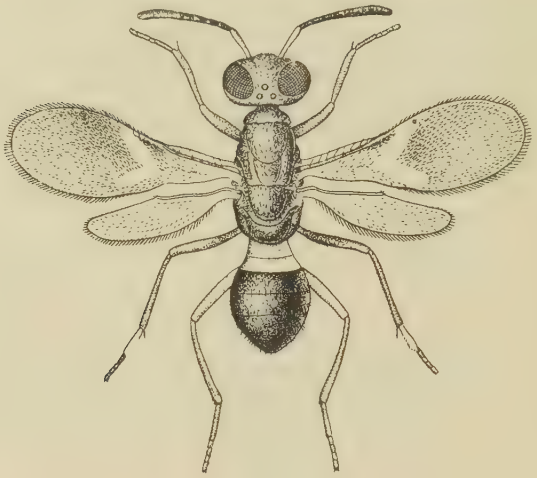

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Fig. 15.—*Anastatus ?dasyni.*

Table 1.

Summary of 10 Batches of *H. lucidus* Eggs from Gedangan—1937.

Batch No.	Date received	No. of eggs	Nymphs hatched	Failed to hatch [2]	Total parasitised	No. of eggs containing				
						Ooencyrtus sp. n.	*Tetrastichus* sp. n.	*Hadronotus homoeoceri*	*Anastatus ?dasyni*	*Ooencyrtus malayensis*
1	28.ii.37	80	37	1	42	17	3	13	9	0
2	7.iii.37	102	42	7	53	27	2	15	9	0
3	15.iii.37	135	88	23	24	7	11	3	3	0
4	24.iii.37	103	63	20	20	1	0	4	15	0
5	30.iii.37	127	65	28	34	10	0	10	14	0
6	6.iv.37	107	66	10	31	3	2	9	17	0
7	13.iv.37	105	69	18	18	15	0	2	0	1
8	20.iv.37	195	159	14	22	14	0	1	7	0
9	27.iv.37	170	158	8	7	4	0	0	1	2
10	7.v.37	118	99	2	17	0	0	6	10	1
Total		1242	846	131	268	98	18	63	85	4
Average			68%	10½%	21½%	8%	1½%	5%	7%	—

[2] Under this heading are included eggs from which nothing emerged. They are probably eggs which had been parasitised at too late a stage for successful parasitism but in which the nymph did not survive, or eggs which had been multiparasitised to the mutual destruction of the parasites, sterile eggs or ones which had been mishandled by the boys who collected them.

Note.—Bugs and eggs became progressively scarcer each week, and it is likely that the later consignments contained a higher percentage of recently-laid eggs which have less chance of containing parasites than older ones.

TABLE 2.

Summary of 8 Batches of *H. lucidus* Eggs from Gedangan—1938.

Batch No.	Date received	No. of eggs	Nymphs hatched	Failed to hatch	Total parasitised	No. of eggs containing		
						Hadronotus homoeoceri	*Anastatus ?dasyni*	*Ooencyrtus malayensis*
1	3.ii.38	97	73	19	4	2	2	1
2	7.ii.38	92	78	10	4	0	4	0
3	14.ii.38	87	69	9	9	2	7	0
4	1.iii.38	123	76	6	41	20	21	0
5	7.iii.38	94	74	9	11	0	9	2
6	14.iii.38	61	45	4	12	4	6	2
7	21.iii.38	108	96	9	3	0	1	2
8	28.iii.38	95	63	8	24	10	14	0
Total		757	574	74	108	38	64	7
Average			76%	9¾%	14¼%	5%	8½%	1%

TABLE 3.

Summary of 3 Batches of *H. lucidus* Eggs from Mt. Salak—1937.

Batch No.	Date received	No. of eggs	Nymphs hatched	Failed to hatch	Total parasitised	No. of eggs containing		
						Ooencyrtus sp. n.	*Anastatus ?dasyni*	*Ooencyrtus malayensis*
1	31.vii.37	100	36	56	8	1	6	1
2	1.viii.37	100	53	40	7	0	3	4
3	12.ix.37	180	144	30	6	0	0	6
Total		380	233	126 [3]	21	1	9	11
Average			61¼%	33¼%	5½%	¼%	2¼%	3%

Dasynus manihotis Egg-parasites in Java.

Twelve batches of eggs of this species were sent from the attacked cassava patches in the uplands of central Java during the period from mid-May to early August. They totalled 500. The parasitism was distributed as follows :—

Hadronotus homoeoceri	1·5%
Anastatus ?dasyni	3%
Ooencyrtus malayensis	6%

[3] As these eggs were collected by local and inexperienced labour, a large proportion of the eggs were damaged during collection. This accounts for the high percentage of non-hatches.

The Egg-parasites' Potentialities.

The fact that a certain percentage of eggs was attacked by a particular parasite in certain localities was only one of the factors to be considered in assessing their suitabilities as controls for the coconut-bug. Others are physical environment, length of life-cycle, ratio of the sexes, reproduction capacity and the number of individuals emerging from the host-egg, range of hosts and enemies.

Physical environment.—As the range of temperature and humidity and of sunshine and shade, within which these parasites are found in Java, covers and is considerably greater than that of the coconut plantations in the Solomon Islands, it was reasonable to suppose that they would adapt themselves to conditions there. (In the Solomons, the mean temperature at sea-level is 82–83° F. and the range is from 73° to 95° F. In Java, the mean coastal temperature is about 80° F., and the range is very similar to that of the Solomons. Both countries have a very high relative humidity, though in central and east Java it is lower during the " dry " season.)

Length of Life-cycle.—To have any chance of success, the life-cycle of a parasite must be shorter than that of its host, and the shorter it is in comparison, other conditions being equal, the more rapidly will it multiply compared with its host and the more speedily should its control be exercised. The life-cycle of *Amblypelta* in the Solomons (from oviposition to adult) is 36–40 days [4]: that of the parasites tested was found to be as follows :—

Parasite	Cycle in Java (days)	Cycle in Solomons (days)
Ooencyrtus sp. n. . . .	10–13	13–14
Tetrastichus	Unknown	—
Hadronotus homoeoceri . .	10–11	12–15
Anastatus ?dasyni . .	13–24	19–21
Ooencyrtus malayensis . .	11–16	11–13

Ratio of the Sexes.—The following is the sex-ratio for the host and its parasites :—

Species	Male : female
Amblypelta cocophaga . . .	3 : 2
Ooencyrtus sp. n. . . .	1 : 1
Hadronotus homoeoceri . .	1 : 1
Anastatus ?dasyni . . .	1 : 3
Ooencyrtus malayensis. . .	1 : 3

Range of Hosts.—None of these parasites is absolutely specific, but *Homoeocerus* and *Anastatus* have a very narrow host-range, while *Ooencyrtus* sp. n. and *O. malayensis* have a fairly wide one. *Tetrastichus* has apparently a narrow range. This parasite was found only in the early batches of eggs sent from Gedangan, at which time it was not possible to procure a fresh supply of *H. lucidus* eggs for parasitisation. Consequently the eggs of *H. marginellus*, *Nezara viridula* L. and a *Riptortus* sp. were used. Attempts to rear *Tetrastichus*

[4] But the adult will not start laying till at least 15 days after moulting, so that the minimum complete life-cycle must be 7–8 weeks. The egg-parasites start laying 2 or 3 days after emergence.

in the eggs of these bugs failed, so the stock of this parasite died out before any batches could be made up for transport overseas.

The following hosts were successfully used in Java and the Solomons for the breeding of these egg-parasites :—

Parasite	Hosts used in Java	Hosts used in Solomons
Ooencyrtus sp. n.	*Homoeocerus lucidus* *H. marginellus* *Nezara viridula* *Riptortus* sp.	*Plautia* sp. *Riptortus* sp. *Amblypelta cocophaga* *Mictus* sp. (in Queensland).
Hadronotus homoeoceri	*Homoeocerus lucidus* *H. marginellus*, but usually only ♂♂ emerged	*Amblypelta cocophaga* *Amblypelta* sp. n.
Anastatus ?dasyni	*Homoeocerus lucidus* *H. marginellus*, but usually only ♂♂ emerged	*Amblypelta cocophaga* *Axiagastus cambelli* *Vitellus* sp. *Philia* sp. 2 other undetermined Pentatomids.
Ooencyrtus malayensis	*Homoeocerus lucidus* *H. marginellus* *Nezara viridula* *Chrysocoris atricapilla* Guérin *Physomerus grossipes* Fabr. *Leptocorisa* sp. *Plautia* sp. *Cletus* sp.	*Amblypelta cocophaga* *Axiagastus cambelli* *Riptortus* spp. *Leptocorisa* sp. *Vitellus* sp. *Philia* sp. 2 other undetermined Pentatomids.

Thus all the Javanese Dasynine egg-parasites were found to attack *Amblypelta* successfully. The fact that *O. malayensis* has such a wide host-range and that it will parasitise *Axiagastus cambelli* Distant (a much commoner coconut-bug) should help its distribution in the plantations very greatly; while because of the smallness of the *Amblypelta* population and the fact that very few alternate hosts for it are present, *Hadronotus homoeoceri* may not establish itself successfully in the Solomons. Both it and *Anastatus ?dasyni* must at best take a very long time before they can exercise any effective control, though ultimately they may prove of value, particularly the latter, as it seems to parasitise both *Amblypelta* and *Axiagastus* equally readily.

Reproduction capacity.—The following figures are founded on somewhat insufficient data (only half-a-dozen tests in each case) and are therefore only a rough guide :—

Species	Average no. eggs parasitised by ♀	Average no. parasites from 1 egg	Average length adult life
Hadronotus homoeoceri . .	63	1	25 days
Anastatus ?dasyni . .	24	1	18 days
Ooencyrtus malayensis . .	20	5	18 days

In the case of *O. malayensis*, there is extraordinary variation in the number of individuals hatching from one host-egg, depending on its size : in our

experiments this varied from 1 to 18 individuals. *Amblypelta* can oviposit about 150 eggs in 2 months, and an adult life of 3 months appears to be the maximum for this bug.

Enemies.—On this point nothing is known, but it is certain that the parasites must have a number of enemies in their Javanese habitat, predators and hyperparasites, which in conjunction with other environmental factors keep them in check. In the Solomons, the fauna is very much poorer, and the number of possible enemy species is bound to be fewer : so that there is a good chance that one or more of the parasites may increase more rapidly than in Java—always providing their opportunities for reproduction are sufficient and that other inimicable environmental factors do not nullify this advantage.

Rearing the Egg-parasites.

Particulars of the technique used for rearing *Ooencyrtus malayensis* are given on page 121, and the methods used for the other egg-parasites were identical. At first the only parasite bred for shipments was *O. malayensis*, but as other species were discovered, it became necessary to rear them all simultaneously, as far as the supply of suitable host-eggs permitted. To facilitate matters at the receiving end, differently-coloured cards were used for each parasite. When shipping them, food in the form of a damp and split raisin, encased in cotton mesh, was fastened inside the upper part of each tube, in case any parasites emerged during the journey (fig. 16, p. 121).

Transport of the Parasites.

The quickest way to send parasites from Java to the Solomons is by air to Brisbane and thence by boat to Tulagi. Allowing for the wait at Brisbane, this takes at least 15 days, and as the life-cycle of *Ooencyrtus* averages 13 days, it was thought best at first to arrange for a half-way breeding-station at Brisbane. This arrangement delayed the despatch of the first shipment considerably, for the Australian authorities' sanction had to be obtained to land the parasites at Brisbane and this did not arrive until March. While waiting for this, tests were made on the cold-storage of eggs for varying periods. Van der Vecht had made previous experiments with cold-stored *Homoeocerus* eggs, parasitised by *Ooencyrtus*, and found that if the eggs are placed in the refrigerator at 52° to 59° F. one day after they have been parasitised, they may be kept there for 2 or 3 weeks and will then emerge from 7–8 to 12–13 days after removal from cold-storage. By this means the life-cycle of 13 days can be prolonged up to 29–34 days and a good supply of parasitised eggs can be prepared for shipment from successive daily batches, cold-stored for a convenient series of periods.

On 12th March 1937, the first batch (which included some refrigerated eggs) was sent to Brisbane, and it was found that parasites in eggs which had been cold-stored longer than 10 days either did not emerge at all or that only a few of them did. Nevertheless the control samples kept at Buitenzorg all hatched successfully.

Accordingly, none of the second batch (335 eggs) was cold-stored longer than 9 days, with the result that there was 100% emergence of the parasites at Brisbane. Two other shipments followed : then, it was decided to send shipments to the Solomons without any intervening stage, arrangements being

made for their cold-storage on the ship at a temperature fluctuating between 53° and 62° F.

In preparation for this, a number of tests were made at Buitenzorg, simulating the varied temperature conditions to which the parasitised eggs would be exposed from the time of parasitisation to their arrival in the Solomons. The new parasites found at Gedangan were used, and they withstood the alternate hot and cold temperatures well. From March to August 1937, seven shipments of parasitised eggs were sent to the Solomon Islands and an eighth shipment was made in March 1938. These eggs totalled 11,484 made up as follows :—

Ooencyrtus malayensis	8761
Ooencyrtus sp. n.	1964
Hadronotus homoeoceri	348
Anastatus ?dasyni	411

From these batches from Java, several hundreds of thousands of parasites were reared in the islands of Malaita and Guadalcanal in the eggs of local bugs and then released at intervals into the coconut plantations.

Search for Controls in Other East Indian Islands.

As no significant controls other than egg-parasites had been found in Java, it was decided to look for them in other parts of the Netherlands Indies, where species of *Amblypelta* were known to exist. Searches were made in Bali, Lombok, Celebes, Flores and Timor. Species of predators which attacked Coreids were found in Minehasa (Celebes) and Amarasi (Timor), and shipments of these were made : but owing to poor transport facilities and other obstacles, they did not survive the journey.

Food-habits of the Dasynini.

A consideration of such members of this subfamily as came within the scope of my investigations shows that nearly all are bugs with an indigenous food-plant which have become pests of introduced, cultivated crops. Usually the attack is made in small numbers, and the damage inflicted is disproportionately great, indicating that the punctures are toxic to their new host, though comparatively innocuous to their indigenous food-plants. The sporadic nature of its attacks, the small area affected and the difficulty of rearing it on cassava combine to suggest that *D. manihotis* is as yet incompletely adapted to its new food, and investigation may show that this is also true of the Queensland species *D. fuscescens* and *Amblypelta lutescens*, whose sporadic attacks on bananas offer a striking parallel. In the case of *Amblypelta cocophaga*, the bug appears now to be adapted to its new host-plant (coconut). It may be true that the coconut-palm is indigenous to the Solomons, but it is the newly-planted European plantations that have been attacked, and this attack has come from bugs feeding on " bush " hosts in the interior. *Homoeocerus lucidus*, on the other hand, though an allied species, is not a true member of the Dasynini and does not exhibit their harmful tendencies; for it has never been recorded as attacking any of the numerous exotic and native crops, which have been cultivated for so long a period in its habitat.

I append a table, showing some species of Dasynine bugs with some of their indigenous host-plants and the crop-plants they have begun to attack.

Species	Habitat	Indigenous host-plant	Crop-host
A. cocophaga . . .	Solomon Is.	*Ficus leucantotoma* *Macaranga tanarius*	Coconut Kapok Cassava
A. gallegonis . . .	Solomon Is.	Unknown	Cassava
A. lutescens . . .	Queensland	*Melia dubia*	Banana Papaya
D. fuscescens . . .	Queensland	*Pisonia bruniana*	Banana
A. nitida . . .	Queensland	Unknown	Mandarin
D. piperis . . .	Sumatra Borneo Bangka	?Wild peppers	Pepper
D. manihotis . . .	Java	*Albizzia procera* *Albizzia lebbeck* *Acacia villosa*	Cassava
D. kalshoveni . . .	Java	*Melia azedarach*	None

Summary.

In an attempt to control *Amblypelta cocophaga*, a Coreid causing immature nutfall of coconuts in the Solomon Islands, a search was made for parasites of allied species in the Netherlands Indies.

An investigation was made on the bionomics and life-histories of two such bugs in Java : *Homoeocerus lucidus* Walk. and *Dasynus manihotis* Blöte. A number of egg-parasites was found and studied, and batches of these were reared and shipped to the Solomon Islands. No parasites of the adult and nymphal stages were discovered.

H. lucidus feeds on *Albizzia lebbeckoides*, an undergrowth shrub of the lowland teak forests, during the wet monsoon; but the population there disappears before the dry season sets in. During this latter period, *H. lucidus* may be found feeding on *Albizzia stipulata* at elevations up to three thousand feet.

D. manihotis occurs in the Goenoeng Kidoel of central Java, where its host-plant is *Albizzia procera* : *Acacia villosa* and *Albizzia lebbeck* may also be host-plants. Occasionally this bug attacks adjacent patches of cassava, causing serious injury where it occurs. A curious feature of all these attacks is that they have been confined to small areas : and from this and from the difficulty experienced in rearing them on cassava, it would seem that the bug is as yet incompletely adapted to this food-plant.

Research on the Dasynini appears to indicate that these bugs have a tendency to become pests of cultivated crops. Usually the attack is made in small numbers and the damage inflicted is disproportionately great, suggesting that the punctures are toxic to their crop-host, though they are not, or only very slightly, toxic to their original host-plants.

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